Journal of the Society of Arts.

FRIDAY, JANUARY 15, 1869.

Announcements by the Council.

SWINEY BEQUEST.

A meeting of the judges appointed under the will of the late Dr. Swiney is hereby summoned to be held on Wednesday, the 20th of January inst. (being the anniversary of his death), when the bequest under the said will, in favour of the "author of the best published Treatise on Jurisprudence," will be adjudged. The meeting will take place at the House of the Society of Arts, at four o'clock, p.m.

(By order) P. LE NEVE FOSTER,
Secretary.

13th January, 1869.

ORDINARY MEETINGS.

Wednesday Evenings at eight o'clock :—

JAN. 20.—"On Photography and the Magic Lantern, applied to the Teaching of History. By SAMUEL HIGHLEY, Esq., F.G.S. Practically illustrated.

CANTOR LECTURES.

The Second Course of Cantor Lectures for the present Session will be "On Painting," by S. A. HART, Esq., R.A., late Professor of Painting at the Royal Academy, and will consist of Four Lectures, to be delivered as follows :—

LECTURE I.—MONDAY, FEBRUARY 1ST.

On the History of Portrait Painting.

LECTURE II.—MONDAY, FEBRUARY 8TH.

On the Practice of Portrait Painting.

LECTURE III.—MONDAY, FEBRUARY 15TH.

On the Suggestions offered by surrounding circumstances to the Artist.

LECTURE IV.—MONDAY, FEBRUARY 22ND.

On Landscape Painting.

Each lecture will begin at eight o'clock. These Lectures are open to Members, each of whom has the privilege of introducing two friends to each Lecture. Tickets for this purpose will be forwarded with next week's *Journal*.

INSTITUTIONS.

The following Institutions have been received into Union since the last announcement :—

Greenwich (East), Science Classes, St. Mary's National School.
Ramsgate, Church Institute and Literary Society.
Spring Vale (Hammersmith, W.), Institute and Evening Classes.

FINAL EXAMINATIONS, 1869.

NOTICE TO INSTITUTIONS AND LOCAL BOARDS.

In order to avoid holding these Examinations on the same evenings as those of the Department of Science and Art, it has been decided to hold them, in 1869, on the evenings of

TUESDAY, the 20th APRIL,
WEDNESDAY, the 21st ,,
THURSDAY, the 22nd ,,
FRIDAY, the 23rd ,,

From 7 p.m. to 10 p.m., instead of on the 27th, 28th, 29th, and 30th April, as announced in the Programme of Examinations for 1869.

In consequence of this alteration the Previous Examinations must be held earlier, and the Forms No. 2 and No. 4, referred to in par. 6 of the Programme, must of course be sent in a week earlier than the dates there fixed for receiving them.

It is very important that this alteration should be made as public as possible. For this purpose a number of small slips, to be inserted between pages 8 and 9 of every Programme sent out, have been forwarded to each Institution and Local Board. They should also be specially sent to any person to whom Programmes may have already been forwarded.

Large bills, to be suspended on the walls of the Institution reading-room, or in some other public place, will also be sent on application.

Proceedings of the Society.

CANTOR LECTURES.

"ON THE ANILINE OR COAL TAR COLOURS."

BY W. H. PERKIN, ESQ., F.R.S.

LECTURE III.—DELIVERED MONDAY, DECEMBER 21ST.

Various Aniline, Phenol, and Naphthalin Colours—Application of the Coal Tar Colours to the Arts.

Last lecture we considered, among other subjects, magenta and some of its coloured derivatives, as the blues and violets. This evening we commence with some of the green colouring matters which have also been produced from magenta. The first green colouring matter we shall consider is the "aldehyd green," which owes its name to a substance called "aldehyd" being employed in its preparation. I must, therefore, first tell you what aldehyd is.

Aldehyd is a product of the oxidation of alcohol; it is a volatile liquid possessing a very peculiar odour, and was discovered by a chemist named Döbereiner, but analysed by Liebig. It is obtained by treating alcohol with a mixture of bichromate of potassium and sulphuric acid, and was generally prepared in glass retorts, but, now that it is required for colour making, the glass apparatus is replaced by copper or leaden vessels.

Towards the end of 1861, M. Lauth described a reaction by which rosaniline could be made to produce a blue colouring matter; but this product was found to be useless as a dye, on account of its instability. It was produced by the action of aldehyd upon a solution of rosaniline and sulphuric acid. This useless colour was afterwards experimented upon by a dyer named Chirpin,

who, after a number of fruitless attempts at fixing it, told his difficulties to a photographic friend, who evidently thought if it was possible to fix a photograph it was possible to fix anything else. He, therefore, advised his confidant to try hyposulphite of sodium. On making this experiment, however, the dyer did not succeed in fixing his blue, but found it converted into a splendid green dye, now known as aldehyd green.

To prepare this colouring matter, a cold solution of magenta, consisting of one part of colouring matter dissolved in a mixture of three parts of sulphuric acid, and one part of water, is employed; about one and a-half parts of aldehyd are added by degrees to this solution, and when the whole is mixed it is heated on a water bath, until a drop of the product diffused in water produces a fine blue colouration. It is then poured into a large quantity of boiling water, containing three or four times as much hyposulphite of sodium as the magenta employed. After boiling a short time the product is filtered off from a greyish insoluble residue which forms. The filtrate contains the green. This process being a very simple one, a great number of dyers now prepare the colouring matter as they require it. It may, however, be precipitated by means of tannin or acetate of sodium, collected on filters and drained to a paste, and, if necessary, dried. In both these forms it is found in the market.

The aldehyd green is principally employed in silk dyeing. It is a splendid colour, and very brilliant both by day and artificial light. The chemistry of this green is at present hidden in obscurity, as it is very difficult to obtain in a chemically pure condition. But like the colouring matter previously described, it is undoubtedly the salt of an organic base apparently containing sulphur.

This base is colourless, or nearly so, and becomes changed to the normal colour of aldehyd green upon absorption of carbonic acid.

It will also decompose ammonia salts, combining with the acid and becoming green. I have here a solution containing the colourless base of this green, an ammonia salt and a little free ammonia. If I pour it upon a piece of white blotting-paper it does not stain it, but if I heat it the ammonia salt is decomposed, and we get the green developed with its ordinary intensity.

There is another green of an entirely different nature to the aldehyd green; it is called the iodine green. This colouring matter is always produced, but in variable quantities, in the preparation of the Hofmann violets, from magenta and iodide of ethyl or methyl. Of late much attention has been directed to this colouring matter, and by making a few alterations in the process for preparing the Hofmann, from forty to fifty per cent. of product can now be obtained from the magenta used. The iodine green is much used for cotton and silk dyeing; its colour is bluer than that of aldehyd green, and it is, therefore, more useful, as it yields, with the addition of yellow, a greater variety of green shades.

Iodine green contains an organic base which is not precipitated by alkaline carbonates. With picric acid it forms a difficultly-soluble picrate, and is generally prepared on the Continent as a paste consisting of this colour precipitated with picric acid and drained on a filter. In England it is, however, sold in alcoholic solution. It is a good green by gaslight.

The next green I have to bring before you is a magenta derivative, commercially called "Perkin's green." In its properties it resembles more closely the iodine than the aldehyd green, but differs from this in its solubility, and in being precipitated by solutions of alkaline carbonates, as carbonate of sodium. It is an organic base which is nearly colourless, and is by no means a chemically powerful body. Like the iodine green, it is precipitated by picric acid, forming a picrate which crystallises from alcohol in small prisms with a golden reflection. This colouring matter is principally employed for calico printing, and is now extensively used. Thus you see we have three aniline greens, some useful for one, and some for another purpose, so that the silk and cotton dyer, and the calico-printer, as well as others can be supplied. For fastness these greens are, I think, quite as good as the violets; the aldehyd green, however, I believe, resists light the best.

In the formation of the mauve, or aniline purple, there is always a small quantity of a second colouring matter produced, of a rich crimson colour, similar to that of safflower. Several years ago I examined this substance, and found it to dye silk a remarkably clear colour, but owing to the press of other matters, and the very small quantities in which it could be obtained, I did not give it any further attention. By a new process, however, it can now be produced in somewhat larger quantities, and endeavours are being made to introduce it to the arts, as it produces beautiful tints of pink upon silk and cotton, and, moreover, can be used for printing cotton, silk, and wool processes, to which safflower cannot be applied as it will not bear steaming. This aniline pink or crimson is a beautiful chemical body, crystallising in small prisms, possessing a golden green lustre. It is soluble in alcohol, and also in water; it produces solutions remarkable for their fluorescence, so much so, that by certain lights they appear as if filled with a precipitate. In colour and fastness it is equal to safflower, and should it be found possible to manufacture it at a moderate price, I should imagine it would entirely supersede that colouring matter, especially as it is not affected by alkaline solutions.

There is a product in the English market supposed to be an aniline colour called "Field's orange," after its discoverer Mr. Frederick Field. Its properties are those of a nitro-acid, but as its preparation has not been described, of course I cannot tell you anything about it. With alkalies it forms a rich orange-coloured solution, but by the addition of an acid it is precipitated as a pale yellow powder.

Field's orange is a very useful colouring matter, having a great affinity for animal fibres, and is extensively used for wool-dyeing, as it resists the action of light very well.

We now come to a colouring matter of a very indefinite nature. I refer to aniline black. This substance appears to be closely allied to the insoluble part of the black precipitate formed in the manufacture of the mauve. This precipitate, however, always contains oxide of chromium, which cannot exist in the aniline black generally employed, as no chromium compound is used in its preparation, but as copper compounds are used, it may be that aniline black represents the black precipitate with the oxide of chromium replaced by the oxide of copper, or it may even be that in either case the metallic oxide is not an essential part of this black substance.

Aniline black is perfectly insoluble, and has, therefore, to be formed upon the fibre when employed for calico printing. As we shall have to refer to its application to dyeing and printing, I will not make any further remarks upon it just now.

From mauve and magenta, chocolate maroons and browns are prepared, but, as they are of secondary importance as yet, I will only just mention one or two of the methods of preparing them.

One of the processes for preparing chocolate from magenta is by the action of nitrous acid, but care has to be taken to watch the progress of the operation, and to stop it when the required shade has been obtained. Another process consists in heating magenta with hydrochlorate of aniline to a temperature a little above 200° C. The product, when purified, produces a maroon colour. Browns are generally obtained from the residue of magenta making.

All the colouring matters we have considered up to the present time are derivatives of aniline and toluidine, and constitute nearly all the colours of the rainbow.

By the action of nascent hydrogen upon dinitrobenzol, Mr. A. H. Church and myself obtained, in 1857, a

crimson colouring matter, which was named nitrosophenyline. I have lately made a few new experiments upon this remarkable body, and find that it has an affinity for pure cotton, dyeing it of a clear cerise colour, considerably less blue in tint than safflower. With very dilute acids, this colouring matter forms a blue solution; with less dilute acid, a crimson colour; and with concentrated sulphuric acid, a green colour. It is difficult to judge of the probable utility of this colouring matter, as it is so difficult to obtain in quantity by the present process. I may mention that my new experiments with this substance have caused me to doubt the purity of the product examined by Mr. Church and myself; and this is not remarkable when we consider how few methods of purifying artificial colouring matters were known at the date of our experiments, as well as the small amount of substance at our disposal.

We now turn to a product very different from aniline, though related to it in some respects very closely. On the table you will see a coal-tar product called "phenol" or "carbolic acid." It was discovered, a long time since, by Runge, and afterwards studied by a great number of chemists. It is only, however, during the last few years that it has been introduced into commerce in a pure condition, thanks to Dr. Crace Calvert, so well known to the Society of Arts.

Phenol or carbolic acid is a splendid crystalline body, possessing many most interesting properties; but I must confine myself to a short account of its coloured derivatives only.

Carbolic acid, when treated with nitric acid, yields a yellow acid, known as picric acid. This substance can be produced from many other bodies besides carbolic acid, and when first employed for dyeing purposes was generally prepared from the resin of the *Xanthorrhea hastilis*, but now, owing to the cheapness and purity of carbolic acid, I believe it is exclusively used in its manufacture. Picric acid requires care in its preparation, if phenol and strong nitric acid be employed, as the action is very violent. Pure picric acid is of a very pale yellow colour; it is employed principally for silk dyeing, the colour it produces on silk being much darker than that of the acid itself. Picric acid has a very bitter taste, and by some it is said to be a great improvement upon hops, in the manufacture of bitter beer, especially as it has been proposed as a tonic in place of quinine. Picric acid forms beautiful yellow salts, the most interesting being that of potassium. This salt is extremely insoluble in water, and very explosive; it has been proposed as a substitute for gunpowder for charging shells. Picric acid, under the influence of cyanide of potassium, is perfectly decomposed, and changed into a new compound called isopurpuric acid, a substance isomeric with murexide. The potassium salt of this compound is very explosive, and, to avoid danger, it is generally supplied in a moist condition, and mixed with glycerine. It produces a kind of maroon colour upon wool, but I do not think it has been extensively used up to the present.

Runge, when experimenting with the products of the distillation of coal, obtained two compounds, called by him rosolic and brunolic acids, which he regarded as products existing in coal-tar; I think it most probable, however, that these bodies were produced in his process of purification, and did not exist ready formed in coal-tar.

Rosolic acid was afterwards examined by Dr. Hugo Müller, who obtained it from crude carbolate of calcium, which had been exposed to the oxidising action of the air. This process, however, does not yield rosolic acid in quantity, but in 1861, Kolbe and Schmitt described a method of producing this substance, by heating a mixture of oxalic, carbolic, and sulphuric acids. It is stated, however, that this process was discovered by M. Jules Persoz, in 1859. It is by this method that rosolic acid is now manufactured.

Commercial rosolic acid, commonly called aurine, is a beautiful brittle resinous substance, having a slight green metallic lustre; when pure it may be crystallised, and if pulverised forms a scarlet orange powder. Its solutions are of an orange colour, but change with alkalies to a most magnificent crimson. It has not been found capable of very many applications in dyeing and printing, although it produces very good orange shades, and with magenta it makes a very good scarlet.

The great difficulty in applying rosolic acid to the arts is owing to the easy solubility of its salts in water. It appears to be closely allied to rosaniline, as it has lately been found possible to obtain it from this colouring matter.

When heated with ammonia, in a closed vessel, to 120° or 140° C., rosolic acid permantly changes into a new colouring matter of a crimson shade, called "peonine" or "coralline." It forms beautiful tints upon silk, similar to safflower, provided it is kept slightly alkaline, but if treated with the least quantity of acid the freshness of its colour is destroyed. When heated with aniline this colouring matter undergoes a similar change to magenta, being converted into a blue called azuline. This colouring matter, as well as coralline, was discovered by M. Jules Persoz, and patented by M. M. Guinon Marnas and Bonnet in 1862. Azuline, when in the solid state, presents a coppery coloured surface, it is soluble in alcohol, but difficultly so in water. It is not manufactured now, having been replaced by the more brilliant blues obtained from rosaniline, and described in our last lecture.

We must now turn our attention to another series of coal-tar colours, derived from a beautiful product called naphthaline. You will see it on the table of coal tar products, it is a hydrocarbon containing

$$C_{10}H_8$$

and may be obtained in any quantity. It is remarkable for the readiness with which it sublimes, and, like benzol and toluol, it yields with nitric acid a nitro-compound called "nitronaphthaline," a beautifully crystalline body, and this, with iron and acetic acid, yields an organic base called "naphthylamine." This base is solid, and beautifully crystalline, but possesses a very disagreeable odour.

Mr. Church and myself obtained from a salt of "naphthylamine" and a mixture of nitrite of potassium and potash, a beautiful substance crystallising in orange needles with a green lustre. It is called by a rather long name "azodinaphthyldiamine."

This substance is a feeble organic base, and dissolves in alcohol, forming an orange-coloured solution, which changes to a splendid violet colour upon the addition of hydrochloric acid. It has, however, been found useless as a dye, because the purple colour only exists in the presence of free acid, and the orange-colour of the base itself is liable to turn brown when exposed to the light. It would appear probable, however, that azodinapthyldiamine may become useful as the starting-point for new colouring matters, as I have lately succeeded in producing from it a very promising crimson substance, possessing a considerable affinity for animal fibres.

A very beautiful yellow colouring matter has been obtained by Dr. Martius from napthylamine, somewhat similar to picric acid, but of a much more intense colour. It is prepared by treating hydrochlorate of naphthylamine with nitrite of potassium; by this means a substance known as diazonaphthol is obtained; this is then heated with nitric acid, and is transformed into the new yellow, chemically known as dinitronaphthol. This substance is commercially called Manchester yellow. It possesses the properties of an acid. The commercial compound consists of a beautifully-crystalline calcium salt, soluble in water, and dyeing silk or wool a magnificent golden yellow colour.

Owing to an increasing demand for benzoic acid, experiments have lately been made, with a view of obtaining it from naphthaline instead of gum benzoin, &c. For this purpose experiments were made with an acid derived

from naphthaline, called phthalic acid, which, when carefully heated with lime, is found capable of yielding benzoate of calcium, from which benzoic acid can be prepared. But as in these processes secondary compounds are formed, which interest us this evening, I will briefly describe the process employed for obtaining these various substances.

First of all, naphthaline is heated with a mixture of chlorate of potassium and hydrochloric acid; in this way a mixture of chloronaphthaline and bichloronaphthaline is obtained. These products are then heated with nitric acid, and yield a mixture of phthalic acid, and a substance called the chloride of chloroxynaphthyl. The phthalic acid is converted into the calcium salt, and heated with slaked lime to a temperature of 350° or 370° C., to convert it into a benzoate.

It is, however, the chloride of chloroxynaphthyl which interests us now. This substance, when heated with an alkali, yields the salts of an acid called chloroxynaphthalic acid, which may be obtained in a free state by means of hydrochloric acid. When pure, chloroxynaphthalic acid is a pale yellow crystalline powder, forming beautiful compounds with baryta, zinc, and copper. It dyes wool a scarlet colour. The great interest of this substance consists in its supposed relationship to alizarine, the colouring matter of madder, the only difference in composition of chloroxynaphthalic acid and alizarine being in the former containing an equivalent of chlorine in place of hydrogen, thus:—

$C_{10}H_6O_3$ ..... Alizarine.
$C_{10}(H_5Cl.)O_3$ ..... Chloroxynaphthalic acid.

Many endeavours have been made to remove this chlorine, and to put hydrogen in its place, with the hopes of producing alizarine; but, up to the present time, no definite results have been obtained.

I am inclined to think that, although this relationship of composition exists between these bodies, yet that their chemical nature is quite dissimilar. We generally find that chlorinated bodies have similar properties to those from which they are derived or represent. Chloroxynaphthalic acid, however, does not appear to possess properties similar to alizarine. This acid dyes wool readily without a mordant; alizarine only slightly stains it. When boiled with cloth prepared with alumina or iron mordants, it scarcely produces any change, while alizarine yields intense colours.

This process of preparing benzoic and chloroxynaphthalic acids is carried out on the large scale in France, by MM. P. and E. Depouilly, to whom I am indebted for the specimens of these products shown in this lecture. Some of the chloroxynaphthalates are beautifully-coloured salts, and are used as pigments.

Laurent in his researches obtained a body from naphthaline called carminaphtha. This product is now claiming the attention of manufacturers, and is said to produce very fine shades of colour upon fabrics.

Before making any further remarks upon the coal tar colours, I wish to draw your attention to some of their applications to the arts.

I have told you that most of the coal tar colours contain carbon, hydrogen, and nitrogen, and that they are generally organic bases. They differ essentially from most of the vegetable colouring matters, which contain, with but few exceptions, only carbon, hydrogen, and oxygen, and are weak acids. You will thus understand that many difficulties had to be encountered in their application for dyeing and printing, because they would not combine with the ordinary mordants used for the colouring matters of woods, as alumina and oxide of tin. These observations refer to the dyeing and printing of vegetable fibres, and not to silk or wool, as these materials absorb the coal tar colours without the intervention of a mordant.

In silk dyeing, the principal difficulty experienced in applying the coal-tar colours was owing to their great affinity for the fibre, thus preventing the dyer from obtaining an even colour, especially when dyeing light shades. After a time, however, it was found that this obstacle could be overcome by dyeing the silk in a weak soap lather, to which the colour had been added. This not only caused the dyeing to proceed with less rapidity, but also kept the face of the silk in good condition. Silk dyed by this process is left soft, but may afterwards be rendered hard or "scroop" by rinsing in a bath of slightly acidulated water.

This process was first used for dyeing silk with the mauve or aniline purple. It has, however, been since found suitable for nearly all the aniline colours, as magenta, Hofmann, and Britannia violets, &c. For dyeing silk with coal-tar colours of an acid nature, such as picric acid, dinitronaphthol, &c., the silk is simply worked in a cold aqueous solution of the colouring matter, sometimes slightly acidulated, as when using the sulpho-acids of aniline blue or soluble blue. The process of printing silk with aniline colours is comparatively simple. An aqueous or alcoholic solution of the colouring matter is thickened with gum senegal, printed on with blocks, and, when dry, exposed to the action of steam for about half-an-hour. The gum is then washed off, and the goods finished.

In my last lecture I referred to the formation of two colourless products from magenta, the one called leucaniline, and the other hydrocyanrosaniline.

Some few years since, it was found that if silk dyed with magenta has the reagents necessary for the formation of these colourless products printed upon it, what is called a discharge style can be produced. One of the substances used for effecting this change is powdered zinc mixed with gum. This process also applies to all the coloured derivatives of magenta, and yields better results than can be obtained by printing on the colouring matter and leaving the white parts, because the colours are always clearer when dyed than when printed. But this is not all. When printing two colours on silk, say a pattern with a green ground and purple spots, two blocks have to be used, the one for the ground and the other for the spots; and, when removing the first block, the silk often moves slightly, therefore when the spots are put in by the second block they do not exactly register, and thus an imperfect result is obtained. This difficulty, however, can be avoided by taking silk dyed with any of the derivatives of magenta, and printing it with the discharge previously mixed with the colour it is desired to introduce, of course employing a colouring matter which is not affected by the discharge, as aniline purple, aniline pink, &c. This discharge style has only been employed for silk at present.

We will now turn our attention to the methods of dyeing wool. These methods, as a rule, are very simple, the wool being merely worked in a hot aqueous solution of the desired colouring matter, no mordant being required. Acids are generally found to be injurious, a neutral bath being preferred, and the operation finished by bringing the temperature nearly up to that of boiling water.

With the blue known as Nicholson's blue, the process of dyeing is different to that just given, and consists of two distinct operations, the wool being first worked in an alkaline solution of the colour, which gives it a kind of grey or slate shade, and then in an acid bath, which developes the colour.

The printing of wool is similar to that of silk, the colouring matter being simply thickened with gum, printed on the goods, steamed, and then washed.

The dyeing of cotton with aniline purple at first presented many difficulties. This colouring matter was found to be capable of producing a very beautiful colour without a mordant, and it was proposed to employ it in this manner, but the colour thus obtained would not bear washing, being nearly all removed with hot water and soap. Mordants, such as alum, were then experimented with, but these gave no results. After some time Mr. R.

Pullar and myself found a method of applying this colouring matter to cotton, which is based upon the insolubility of the compounds it forms with tannin. In using this process the cotton is first soaked in a decoction of sumac or some other tannin agent, then in a solution of stannate of soda, and, lastly, in water, slightly acidulated with sulphuric acid. The cotton thus prepared contains an insoluble compound of tin and tannin, and which possesses a great affinity for aniline purple. The stannate of soda may be replaced by alum, or a solution of tin salt. This method of preparing cotton has been found suitable for nearly all the aniline colours discovered since the mauve, and is now almost universally employed in Great Britain for cotton dyeing. Other processes have been proposed for cotton dyeing, but are not so generally employed as the one just described.

We now pass on to the application of coal-tar colours to the art of calico printing. The mauve, when first introduced, was applied to printing in a very simple manner; the colouring matter was merely mixed with gum and albumen, printed on the goods and steamed; by this process the albumen became insoluble, and fixed the colour. Caseine and gluten were sometimes used as substitutes for albumen. Being dissatisfied with this mechanical mode of applying aniline purple, in conjunction with Mr. Grey, I made a number of experiments with a view of obtaining some more chemical method of fixing this colouring matter, and at last succeeded. The process proposed consisted in printing the pattern with a salt of lead, then converting this into the oxide or a basic salt, by passing the goods through an alkaline solution. Thus prepared, they were worked in a boiling solution of aniline purple in soap. In this way a very pure colour was obtained on the mordanted parts, the soap keeping the whites pure. This process, however, was of very limited application, as it could only be applied for single-colour patterns. After this, several processes were patented for the use of tannin for fixing the mauve; these were based upon the method of dyeing cotton previously mentioned, and some very fast results were obtained, but as these methods are now out of use, I will not describe them further.

The process now nearly universally employed in the north was discovered by M. Alexander Schultz and myself; in consists in printing the colouring matter with a mordant composed of a solution of arsenite of alumina in acetate of alumina. On steaming the cloth printed with this mixture for about half-an-hour, the colour is firmly fixed in the fibre. After steaming, the goods are generally soaped, and then finished. One of the great advantages of this process is that it can be worked in patterns with a great variety of colours, and is also suitable to nearly all the aniline colours, as well as the mauve, yielding shades of great brilliancy.

During the last few years, much attention has been given to the application of aniline black to calico printing. This substance is not prepared in the separate condition, but formed on the fabric; it is produced by printing a mixture of a salt of aniline, chlorate of potassium, and sulphide of copper, thickened with starch, upon the goods, and in this manner a dull grey impression is obtained; but, after three or four days ageing, this changes to a dark olive, and is then rendered perfectly black by passing the goods through a dilute solution of carbonate of soda. This colour is very fast, but is inclined to acquire a slightly green shade by long exposure to the air. Unfortunately, it cannot be printed on with other colours, because when steamed the cotton is destroyed by the acid character of the mixture employed for its formation. It can, however, be printed on at the same time as madder mordants, and these can be afterwards dyed with a lead mordant, so that when passed through bichromate of potassium, a pattern with black and yellow or orange can be obtained.

The aniline colours have produced quite a revolution in the arts of dyeing and printing, and have made these processes far simpler than they were, and there is such a variety of shades of colour now sent into the market, that the dyer or printer has little else to consider than the intensity of the colour required; and, in fact, if a dyer has a large order to execute of a particular shade of colour not in the market, he will not trouble about matching it himself, but sends to the colour manufacturer to supply him with a product capable of yielding the required shade.

Besides dyeing and calico-printing, several other branches of industry have benefited by the coal-tar colours, such as the arts of lithography, type-printing, paper-staining, and colouring, &c. Before they could, however, be used for these various purposes, it was necessary that they should be made into lakes or pigments, by union with alumina or other suitable base; but as most of the aniline colours are of a basic nature, it was found impossible to combine them directly with a metallic oxide like alumina; advantage was, therefore, taken of their affinity for starch granules, and some very brilliant products were obtained by dyeing powdered starch with the cold aqueous solution of these colouring matters. These starch powders, however, are wanting in covering power or body, so that other processes had to be sought for, and now these lakes are made upon an alumina base, by the intervention of tannin or benzoic acid.

Many attempts have been made to prepare a pigment from rosolic acid or aurine, and this, to some extent, has been accomplished by precipitating a solution of the colouring matter with alumina; by this process, a bright orange-scarlet coloured product can be obtained; it is, however, only suitable for paper-staining. I have, therefore, lately been further experimenting in this direction, and have succeeded in forming a very brilliant scarlet pigment, which can be used for printing inks and a variety of other purposes.

Upon the table there are some specimens of magenta, Britannia violet, aniline blue, green and orange lakes, and also some very beautiful and intense-coloured preparations of coal-tar colours, now generally called carmines. These lakes, when ground with printers' varnish, produce printing inks of very great brilliancy, and are extensively used for this purpose, and Mr. Hanhart, whose name is so intimately connected with the art of lithography, has most kindly furnished me with the various illustrations of the application of these products to lithographic printing for this lecture.

These lakes in a wet condition are being largely used for paper-staining, and also for paper colouring, as well as for a variety of other less important purposes.

The peculiar bronze surface produced by evaporating a solution of an aniline colour, has been taken advantage of by the manufacturer; and all the bronze bonnets, hats, flowers, and feathers, so much worn in the autumn of last year, derived their lustre from aniline colours. When first employed for this purpose, no fixing agent was used with them, and as they are mostly soluble in water, a shower of rain was often found to cause beautiful purple drops to fall from these bronzed bonnets and hats, and produce a kind of mottled pattern upon the white collars, and sometimes even upon the face of the wearer.

Aniline colours are used for writing inks, colouring soap, &c., but as these applications are only of small importance in a commercial point of view, I will not spend time in speaking about them.

I have in these lectures brought before you in a rapid —I fear too rapid—manner, an account of most of the coal-tar colours; but, before concluding, I should like to show you the close relationship which exists between some of them, especially between those derived from rosaniline or magenta.

I have endeavoured to show you that the derivatives of magenta closely agree in properties, all of them containing colourless organic bases, the colour being developed upon their combining with acids. But I

now wish to show you more than this, by briefly explaining their chemical structure. To describe this thoroughly it would be necessary for me to enter fully into the chemical theory of substitution; but as this would occupy a great deal of time, I must content myself with just mentioning a few facts connected with that subject.

Rosaniline and its derivatives contain carbon, hydrogen, and nitrogen, as I have told you on a previous occasion. Chemical substances containing hydrogen often hold it in what is turned a replaceable condition, that is, in such a condition that it may easily be removed, and another substance of equal value (either simple or compound) introduced in its place. A compound substance, capable of replacing hydrogen, is called a "radical," and I want to speak about two of these radicals, one called ethyl, and contained in iodide of ethyl, the other called phenyl, and contained in aniline.

Ethyl contains C_2H_5
Phenyl „ C_6H_5

I will first mention a familiar instance of the replacement of hydrogen by a radical. Water is composed of two equivalents of hydrogen and one of oxygen, thus—

$$\left.\begin{matrix}H\\H\end{matrix}\right\}O$$

Now, it is quite easy to remove an equivalent of this hydrogen and replace it by ethyl.

$$\left.\begin{matrix}H\\(C_2H_5)\end{matrix}\right\}O$$

This is water with hydrogen replaced by ethyl, a replacement compound by some very much preferred to water itself; it is alcohol.

Rosaniline contains three equivalents of hydrogen, replaceable by radicals. This is the formula of the hydrochlorate of rosaniline, the three separate H's being replaceable:—

$$\left.\begin{matrix}(C_{20}H_{16})\\H\\H\\H\end{matrix}\right\}N_3,H\,Cl.$$

Now, what takes place upon boiling this salt with aniline? The phenyl of the aniline simply takes the place of the replaceable hydrogen, producing what is called triphenylrosaniline. The result of this replacement is that the rosaniline salt has been changed from red into blue—the bleu de Lyon—which is represented thus:—

$$\left.\begin{matrix}(C_{20}H_{16})\\(C_6H_5)\\(C_6H_5)\\(C_6H_5)\end{matrix}\right\}N_3,H\,Cl.$$

Dr. Hofmann, on observing this relationship, was induced to try whether he could replace the hydrogen in rosaniline by other radicals than phenyl. He tried to introduce ethyl by digesting rosaniline with iodide of ethyl, and succeeded in introducing three molecules of the radical ethyl in the place of the three replaceable hydrogens. I will endeavour to show you how this takes place, by the following equation:—

$$\underbrace{\begin{matrix}(C_2H_5)I\\(C_2H_5)I\\(C_2H_5)I\end{matrix}}_{\text{Three molecules of iodide of ethyl.}} + \underbrace{\left.\begin{matrix}(C_{20}H_{16})\\H\\H\\H\end{matrix}\right\}N_3,H\,Cl.}_{\text{Hydrochlorate of rosaniline.}} =$$

$$\underbrace{\begin{matrix}HI\\HI\\HI\end{matrix}}_{\text{Three of iodide of hydrogen or hydriodic acid.}} + \underbrace{\left.\begin{matrix}(C_{20}H_{16})\\(C_2H_5)\\(C_2H_5)\\(C_2H_5)\end{matrix}\right\}N_3,H\,Cl.}_{\text{Hydrochlorate of triethylrosaniline.}}$$

Here we see the iodine has simply exchanged its ethyl for the replaceable hydrogen of rosaniline, and the result is a blue shade of the Hofmann violet.

Now it is not necessary to replace the three hydrogens; two may be replaced, and we get a less blue violet. Represented thus:—

$$\underbrace{\left.\begin{matrix}(C_{20}H_{16})\\(C_2H_5)\\(C_2H_5)\\H\end{matrix}\right\}N_3,H\,Cl.}_{\text{Hydrochlorate of diethylrosaniline.}}$$

Or one may be replaced, and we get a red violet. Represented thus:—

$$\underbrace{\left.\begin{matrix}(C_{20}H_{16})\\(C_2H_5)\\H\\H\end{matrix}\right\}N_3,H\,Cl.}_{\text{Hydrochlorate of ethylrosaniline.}}$$

When speaking of the violet imperial, I mentioned that it consisted of products intermediate between rosaniline and the bleu de Lyon. These intermediate substances consist of rosaniline with one or two equivalents of hydrogen replaced by phenyl.

Up to the present moment it has only been found possible to replace one equivalent of hydrogen in mauveine, or the mauve dye, and, as I previously mentioned, it is curious that the result of this replacement is perfectly opposite to that which takes place in the case of rosaniline, the replacement of hydrogen by ethyl in rosaniline causing it to become bluer in shade, and the replacement of hydrogen by ethyl in mauveine causing it to become redder in shade. The following is the formula of the hydrochlorate of ethyl-mauveine or dahlia:—

$$\left.\begin{matrix}C_{27}H_{23}\\(C_2H_5)\end{matrix}\right\}N_4H\,Cl.$$

But although I have tried to explain the relationship of these colouring matters as simply as I can, yet, this part of my lecture assumes much of the character of a lecture on theoretical chemistry. Here we are talking about substitution products of bodies, a branch of the highest theoretical chemistry and it must strike us as remarkable, when we find that these considerations have been pressed upon us, by the discussion of bodies which may now be said to be common dye-stuffs. We have also been talking quite in a familiar manner about nitrobenzol, aniline, iodide of ethyl, aldehyd, &c., substances which were, only a few years since, the *recherché* compounds of the laboratory. In fact, the coal-tar colour industry is entirely the fruit of theoretical chemistry. Let us consider the enormous rapidity with which this industry has developed. It only dates from 1856, and now we have large factories for the production of coal-tar colours, not only in Great Britain, but in Germany, France, Switzerland, America, and other countries. I had hoped to have been able to give you a statistical account of this industry, but have not had sufficient time for this purpose. Dr. Hofmann, however, in his report on the coal-tar colours, shown at the Paris Exhibition of 1867, remarks that, "in 1862, the value of these manufactures had risen from nothing to 10,000,000 of francs, or more than £400,000 sterling. At the present day this sum is trebled, which would make it about one million and a-quarter pounds sterling, although the products are much cheaper than they were before." And, now, when you hear of these results, do not forget that they are the truly practical fruits of theoretical chemistry, not studied for the purpose of producing commercial products, but simply for its own sake.

Proceedings of Institutions.

LANCASTER MECHANICS' INSTITUTE.—The forty-third annual report (being for 1868) says that there still hangs over the Institute a heavy debt, which must necessarily cripple its usefulness until liquidated. On the other hand, the committee have to acknowledge with thankfulness some handsome legacies. The library has been considerably enlarged, and 109 volumes added. It now contains upwards of 6,800 volumes. The highest number of members connected with the Institute during the year was 387; the number at present is 269, the falling off being principally amongst the quarterly members. Mr. Dalzell is at present engaged in arranging the fine collection of coins, medals, &c., presented by the representatives of the late Mr. Corbyn Barrow. The receipts of the penny bank for the year ending October 24, 1868, were £560 16s. 9d., and the payments £545 18s. 6d. The income amounted to £374 7s. 8d., and the balance in the treasurer's hands is £57 4s. 4½d. In the science classes the subjects taught have been—Animal Physiology, Elementary Mathematics, Inorganic Chemistry and Analysis, and Geology. During the past session 156 lectures have been delivered, which have been attended by 44 students. The number of students attending the classes is as follows:—Animal Physiology, 32; Inorganic Chemistry, 36; Elementary Mathematics, 10; Geology, 8. In the school of art, the total number of students on the books at present is 328, divided as follows:—Female pupil teachers, 11; gentlemen, 9; school children, 29; ladies, 42; artizans, 68; pupils at several schools, 134. The system of local prizes has proved very successful in giving direction and force to the studies of the pupils. These prizes are, for the most part, confined to the artizan classes. The principal object of competition this year has been to direct the attention of the students to the practical application of drawing, painting, and modelling to manufactures. Prizes have been offered for efforts made in this direction, and also for efforts of a more ambitious character, viz., to gain a more cultivated perception of beauty in form by the study of antique models. Mechanical drawing has also been encouraged.

SOCIETY OF ARTS.

In the paper read by Mr. Davenport on the 25th of November last, it was intended to give more fully the history of the period from the Society's incorporation to 1852, at which time the publication of the *Journal* was commenced, but owing to want of time it became necessary to refer to it but briefly. This portion, in continuation of the paper, is given as follows:—

SECOND PERIOD.

It is an unfortunate fact, and one much to be regretted, that the Society, both in the first and second periods of its existence, was for several years unable to bear the cost of publishing in a concise form a record of its transactions. The natural result is that anyone now desirous of reading up the history of the past, finds himself without any other beginning to his history than such as is generally supplied in the form of a list of names and dates. Our second period is unfortunately without any written record of a concise and intelligible nature, and it will therefore be my object, in what I am about to say, to place a narrative of facts, so far as I know them, in as few words as possible. I shall not attempt to take out from the sixteen volumes of the Society's *Journal*, published since 1852, any lengthy quotations from the various papers which have been read on the industries of this and other countries, papers which include communications on the progress of discoveries in relation to the electric telegraph, the railway system, cotton culture, supply, and manufacture; carpet manufacture, lace, iron, silk and wool, sewage and its uses, the health of towns and industrial pathology, British agriculture and agricultural dwellings, the steam plough and traction engines, our colonies and their products, the structure of ships and our light-house system, water supply and gas lighting as well as many other subject, including unused and unappreciated raw products. I shall rather attempt to indicate the course of action on the part of the Council since the incorporation of the Society by Royal Charter (10th June, 1847), which has resulted in the position which the Society has attained to of late years.

I have already stated that Mr. Arthur Aikin resigned the secretaryship of this Society in 1839. In doing so, he said that "advancing years and a failing memory unfitted him for longer holding an office, the duties of which he felt could only be executed properly by the combination of promptness in applying knowledge already acquired, and activity in keeping up with the continual advance of practical science." Mr. Aikin was a man of progress, and to his foresight and industry is due the change which took place in the character of the Society's meetings. He felt that a broader basis of action must be opened up, if the Society was to keep pace with the times. He therefore proposed and made collections illustrative of industries; and the following notice, in reference to his efforts, appears in vol. xlvii. of the *Transactions*:—"But the Committee feel that they shall scarcely have discharged their duty without some notice of the evening illustrations, which so agreeably occupied the time of the Society during part of the last session. The plan, which originated with the secretary, was to devote each evening to the description of some art or manufacture, in which historical notices should be combined with practical details, illustrated with drawings and specimens, so as to form a summary, at the same time entertaining and instructive, of the most important and curious of those arts which, by calling forth the skill and enterprise of the human race, have eminently contributed to the advance of civilisation and knowledge. The first subjects illustrated were pottery and porcelain, glass, gypsum and the art of casting in plaster, stereotype, type-founding and paper." Thus the seed was sown which, in after years, was to take root, and, under more genial circumstances, give permanent interest to the records of the meetings of the Society; but the time for its full growth had not yet arrived. Nevertheless, Mr. Aikin continued his exertions year after year, and on the 12th May, 1835, a subscription having been made by the members, an acknowledgment of his long and eminent services was presented to him, "in testimony of their high respect for his character, and of their gratitude for the zeal and ability with which he has advanced the objects and promoted the interests of the Society."

It was not, however, till 1841-2 that the Society's doors were opened somewhat wider, so as to admit of communications upon patented inventions being discussed.

COUNCIL PROPOSED.

On December 15th, 1841, at which period the whole business of the Society was managed by the members at their ordinary meetings, a committee was appointed to revise the working of the Society, and recommended that a Council to manage the affairs of the Society should be instituted; that the restrictions which had hitherto fettered the Society, in relation to matters which had been brought before other societies, and which had been protected by letters patent, should be removed. The committee, in its report, says:—"It is needless to give expression to the conviction that the Society cannot continue to exist on the plan of proceeding which is at present pursued. The object of the Society is the promotion of the useful arts, rather than the personal gratification of members. . . The proceedings of the weekly meetings are principally confined to the discussion of rule and order, accounts, and other matters not tending to the promotion of the interests of the Society." To remedy these inherent defects in the management of the

Society, it was further recommended that six committees be established, of five members each, and that the decisions of the committees be maintained as to rewards recommended; that two gentlemen of each committee be elected as chairmen, and constitute the Council, which in turn was to elect its president and vice-president.

The Society did not, however, at this time adopt the recommendation in full, but in lieu of a Council appointed a Committee of Miscellaneous Matters, which emanated from committees elected by the Society, and which committees were open to all the members, the Society reserving to itself the confirmation of the reports of committees.

EXHIBITION OF BRITISH INDUSTRY, ETC., PROPOSED.

During Mr. Whishaw's secretaryship the rules excluding patents from rewards were abolished, and the first attempt at establishing an exhibition was suggested, and in 1844–45 a circular was issued, headed "Proposed Exhibition of the Products of British Industry," in which it was set forth that "The exhibitions of national industry which attract so much attention on the Continent, have suggested to some members of the Society of Arts and to some distinguished manufacturers the propriety of establishing something of the kind in this country." Special subscriptions in aid of the proposition were received, and the originator of the plan, though then unknown, was Mr. Fothergill Cooke, the inventor of the electric telegraph. Exhibitions, as then proposed, were to be of two kinds — industrial and art. The former were to have been limited to British manufacturers, and in the latter case, the artists contributing pictures to the proposed exhibition were, by ballot, to act as the judges of their own works, and were to receive pecuniary rewards, towards which, however, each artist was to contribute £1 1s., to form, with other moneys, a common prize fund. It is scarcely necessary to add, that neither proposition, as originally put forward, was ever carried out.

COUNCIL ESTABLISHED.

In December, 1845, Mr. John Scott Russell accepted the office of secretary, Mr. Whishaw continuing as joint honorary secretary with him in relation to the exhibition proposed. At this date the rules of the Society were again revised, and the recommendation that the management of the Society's business be vested in a Council was adopted, but the old *régime* of rule and order was still perpetuated in a modified form till the incorporation of the Society by Royal Charter, in 1847. To the energy, perseverance, and constant activity of Mr. Thomas Webster, Q.C., the Society is much indebted for the modifications in its laws and system of management. In this he was aided very materially by Mr. (now Sir William) Bodkin.

I have been thus particular in relation to the changes in the rules of the Society, and in the secretarial and other offices, as, in my opinion, the successful raising of the present Society is partly due to the constant changes which then took place. Each newly-elected officer exerted himself to introduce and create an interest on the part of some of his friends, which ultimately resulted in bringing together a body of gentlemen of active intelligence, with minds untrammelled by old associations, and whose want of knowledge of what others had done for the Society in years past, protected them from the imputation of personal feelings.

The Council, appointed under the Society's Regulations of 1845, immediately issued an address to the Society, proposing an enlarged action in aid of which, and the exhibitions above referred to, special subscriptions were received.

A Council having been instituted, a charter of incorporation was soon after obtained. The Council did not, however, delay action till a charter had been obtained, for in the address read to the members on the 17th December, 1845, they state:—

"At this meeting, which forms the commencement of the ordinary scientific business of the 92nd Session of our Society, it has appeared to the Council now charged with the management of your affairs a proper occasion to lay before the members a succinct view of our position and prospects. . . . . Placed in the metropolis of England, long distinguished as the Society charged with the responsibility of seeing that the Arts, Manufactures, and Commerce of this country are encouraged to extend themselves in the right direction, and prosecuted in the most efficient manner, a heavier responsibility is laid upon us in proportion as those arts, those sciences, and those manufactures are making progress around us; therefore it behoves us to advance in the exact proportion in which the rest of our countrymen are advancing in the same direction. Having at our head a Royal personage distinguished not more by his attainments in science and art than by the sincerity and heartiness of his co-operation for their advancement . . . we feel that in our position as a Society, in our history, in the patronage we possess, and in the influence we might wield for the accomplishment of any great and good object, some grievous fault must attach to us, either collectively or as individuals, if we be not found coming forward and prominently exerting ourselves as the zealous, practical, and effective promoters of all that is most beautiful in Art, most useful in Science, or most valuable in the Manufactures and Commerce of the country."

After reviewing what the Society had done in times past, and the means which had been employed in doing it, the Council proceeded to point out that one field for the Society's future action which appeared most capable of successful culture was that which combined art with manufacturing industry, and they the more readily set to work upon that, as it afforded a threefold advantage, viz., that of directing the attention of men of science to the discovery of new agents to be employed in art industries, at the same time that it encouraged the production of more beautiful objects, both of form and colour, and by their production advanced the education of the masses of the people in their appreciation of a higher art.

SPECIAL PRIZES FOR ARTICLES OF MANUFACTURE.

A special fund was obtained by subscription, and prizes were offered, in 1846, to manufacturers and designers for the production of articles of every-day use; and the response to these prizes was the successful starting-point of exhibitions in this country.

Among the articles received in competition for the prizes offered were jugs, mugs, and plates, and a tea-service manufactured by Messrs. Minton and Co. This tea-service was a step leading to the first International Exhibition, and to the high state of usefulness and prosperity the Society has been able to attain to. When the articles were received in competition it was unknown who were the producers of them, and the awards were made by a committee of artists and others, of which the late Sir William Ross, R.A., was chairman. After mature deliberation, the committee awarded the prize offered for a tea-service to a set designed by "Felix Summerly," and manufactured by Messrs. Minton and Co.; and awards were also made to other competitors. The Society was not long in discovering who "Felix Summerly" was, as His Royal Highness Prince Albert, president, presented the prize offered, viz., the Society's silver medal to Mr. Henry Cole, on the 12th June, 1846.

EXHIBITIONS.

British Manufactures. — Fresh prizes were offered and awarded during the session of the Society 1846-7, and the articles now sent in, in competition, together with those rewarded in 1846, and others lent for the purpose, formed the subject-matter of the first exhibition of select specimens of British manufactures, exhibited at the Society's House in March 1847. Of the growth of these exhibitions it is needless to say much

more than that a second was held in 1848, and a third in 1849, by which date the public had become so interested in the action set up, and manufacturers were so much more willing to contribute specimens, that it was difficult to arrange the contributions, and the crowds that visited these exhibitions could not at times gain admission to the Society's rooms. The result of this was that in 1848 it was resolved to group manufactures, and to show sections of industry year by year.

Ancient and Mediæval Art.—In the Session 1846-7, it had been declared to be the intention of the Society to hold "an enlarged and *national* exhibition," and the impossibility of the Society now being able to carry out this intention became so apparent that, in 1850, an exhibition of works of ancient and mediæval art was substituted, as best calculated to afford instruction to artists, manufacturers, and workmen who proposed to become exhibitors at the Great Exhibition of 1851, which had then been determined on.

To the details of the realisation of the Great Exhibition I will refer hereafter, as it will be more convenient that I should state here that, while British manufactures were being thus developed and brought before the public, British art and art-industries, together with the mechanical inventions of the times, were not overlooked.

Lithography.—In December, 1847, an exhibition illustrative of the progress of lithography in England was opened. It included illustrations of engravings on stone, drawing on stone with ink and chalk, printing in neutral tints, and also in gold and colours. There were also drawings with the point, printed in black ink; Hullmandel's graduated tints and prints in colours, from several stones; drawings with the stump; lithographic transfers from engraved plates; and specimens printed by steam machinery. There were also added to the collection a series of specimens of printing from transfers from old prints, newspapers and pen drawings by the anastatic process —a process recently introduced into this country.

Bookbinding. — Other exhibitions of a technical nature were also held, such as ornamental art as applied to ancient and modern bookbinding. At a later date, in 1852, the first exhibited collection illustrative of the art of photography was arranged, and in the same year specimens of the art of colour printing illustrative of the then state of litho-chromatic and typo-chromatic arts were shown. Nature printing was also illustrated.

National Gallery of British Art. — While these industrial art processes were being brought before the public, the Society endeavoured to promote the establishment of a National Gallery of British Art. The object sought to be attained will be best understood by my quoting from a paper prepared and read by Mr. Henry Cole, January 27th, 1847: — "The wish to establish a National Gallery of British Art has found utterance oftentimes and in many ways, but, hitherto, no practical steps have been taken to realise it. A national collection of pictures, which shall worthily exemplify the state and progress of the British School of Art, still remains a public want. . . . We have no public collection of our own painters' works. France and Belgium have been honouring their people by placing before them the works of their painters—but England has hitherto done nothing. . . . . As the Society took the foremost position when British Art made its first step in the establishment of an academy, so it is a fitting sequence that the Society should now proffer its aid and become the first agent to gather together, as in a treasury the fruits of that academy in its years of maturity. With these views, I have suggested that the Society shall organise an annual exhibition of pictures entirely novel of its kind. . . . There would be great interest in bringing together the works of the best artists of our own school—in exhibiting year after year the works of such men as Eastlake, Leslie, Edwin Landseer, Maclise, Collins, Etty, Mulready, Turner, &c. . . . There are many advantages in exhibiting the works of an artist during his lifetime rather than after his death. . . The principal object then of this exhibition is to amass a fund for the purpose of forming a nucleus of a gallery of the best works of British artists—to be thus enabled to give to the artist whose works are exhibited a commission for a picture without dictation as to subject or size. . . . When the picture is painted it is proposed to present it to the National Gallery."

Mulready Exhibition. — With this object in view an exhibition of the works of William Mulready, R.A., was arranged and opened in June, 1848, by which a small sum was realised, but not sufficient to enable the Society to obtain for the nation a picture by Mr. Mulready, but as his fame rested probably as much upon the beauties of his studies in the life school as upon his other works, two examples of such studies were secured by the Society and presented to the National Gallery, to be held in trust for the nation, with power to the trustees to lend the same under certain conditions. As part of the plan, a subscription was also raised in aid of the fund, the subscribers to which were presented with a copy of one of the artist's works; in this case "The Sonnet," lithographed by John Linnel, after the chalk sketch for the picture by William Mulready, was the specimen presented.

Etty Exhibition.—The second exhibition of this series consisted of the works of William Etty, R.A., and was opened to the public on the 9th June, 1849. In the preface to the catalogue of this collection, the Council say—"They are unable to express, adequately, their full sense of the liberal courtesy with which the valuable pictures forming this collection have been entrusted to them for exhibition, and they feel that these acknowledgments are more especially due to the members of the Royal Scottish Academy, whose paintings fill so prominent a place in the exhibition." The subscribers on this occasion were each presented with a copy of Mr. Doo's splendid engraving of Etty's great picture of "Mercy interceding for the Vanquished," one of the series of pictures lent by the Royal Scottish Academy. The catalogue was prefaced with a life of the artist, written by himself. The excessive cost of bringing this collection together, and its failing to produce a balance at its close, induced the Council to give up this series of exhibitions, as they found that it was not likely to produce the funds necessary for carrying out the object for which it was instituted, but, on the contrary, involved a probable heavy charge upon the funds of the Society.

Mr. Etty died on the 13th November, 1849. A few weeks after the exhibition closed, he left London on a visit to Oxford, but, contrary to his original intention, he retained possession of his chambers in the Adelphi, with a view, as he stated, to having a home in London where he might for the few remaining years of his life meet his brother artists during the season. At the end of one month he left Oxford to take up his residence at his house in Carrey-street, York, a house which he had, when a poor boy, looked up to as a house far beyond anything he could aspire to, and the possessor of which he had thought of as the great man of the city, but which house he had lately purchased. After a residence of only a few weeks in his native place he was taken ill, and owing to an internal disorder and a combination of diseases, he expired after a short illness. The sight of that old man, when he first found himself surrounded by the labours of his life, the tears he shed, and the speeches he uttered, will never be forgotten by those who were so happy as to be present with him. And though the collection of his works failed to attain the object for which they were brought together, still the labour of those who made the collection was amply repaid by the high appreciation it elicited from the public, of the works of a man who had been so little understood and so much spoken against.

Though the hope of establishing a Gallery of British Art by means of exhibitions failed of realization, the Council, from time to time, have brought together collections of works by other artists; thus, in 1855, the works of John Chalon, R.A., and those of his brother, Alfred Edward Chalon, were collectively exhibited; and in 1860, an exhibition of the principal works of the then recently deceased Sir William Ross, R.A., was made.

Exhibitions of Patented Inventions.—While the Council were thus anxious to get Art represented in a permanent gallery belonging to the nation, and to aid industrial art by placing new processes before the public, and making known the degree of development which those of longer standing had attained to, it did not disregard the claims of science or the right of invention to be duly represented. Accordingly, in December, 1848, an exhibition of models of modern machinery and improved recent inventions was opened. This collection was the forerunner of a series of exhibitions illustrative of the patents taken out during the twelve months preceding the date of the exhibitions. These exhibitions were continued yearly till 1859, when arrangements were in progress for holding the second great International Exhibition, then proposed to be held in 1861. In the preface to the catalogue of the exhibition opened in November, 1850, attention was drawn to the fact that—"On the eve of a probable radical change in the laws relating to the protection of inventions, and as confirmatory of the justice of the principles on which the Council have appointed the committee who are now working towards that important end, it is interesting to observe among the articles in the catalogue several which, though registered under the Designs Act, are obviously improvements, not substantially in 'form or configuration,' but in 'action, mode, or contrivance,' and, as such, plain evasions." Among the articles so registered was a gas meter, a tubular filter, a new action for upright pianos, a turnip cutter, an Esculapian still, &c., for all of which protection was sought avowedly for "shape and configuration." I must now refer somewhat in detail to the Exhibition of 1851, and some of its results.

GREAT EXHIBITION, 1851.

In June, 1849, the secretary, Mr. J. Scott Russell, stated in presence of His Royal Highness Prince Albert, president, when present at the distribution of the Society's rewards, that, owing to the yearly increasing success of its exhibitions, the Council had no doubt as to their being able to carry out the plan originally proposed for holding a Great National Exhibition of the products of British industry in 1851. This announcement led to immediate and frequent communications between His Royal Highness the President, and the secretary, on behalf of the Society, and it was during this correspondence, and while the Council were investigating the steps necessary to be taken for carrying out the first aggregate exhibition of native manufactures, that the plan was expanded into a proposition for holding the first Great International Exhibition of 1851. It is impossible to detail all the steps which the Society took at this date to secure support in carrying on its work. The promise of a site for the erection of a temporary building for the purpose of holding an exhibition of British industry had been obtained from Lord Carlisle, First Commissioner of Works, and the quadrangle of Somerset-house or Trafalgar-square had been named. The proposition, however, soon vastly expanded, and it became necessary to secure the support and aid of the Government, and on the 31st July, 1849, His Royal Highness Prince Albert addressed a letter to the Home Secretary, in order to bring the subject officially to the notice of Her Majesty's Government. The letter was as follows:—

"Osborne, July 31, 1849.

"SIR,—The Society of Arts having during several years formed exhibitions of works of national industry which have been very successful, believe that they have thereby acquired sufficient experience, and have sufficiently prepared the public mind, to venture upon the execution of a plan they have long cherished, to invite a quinquennial exhibition in London of the industry of all nations.

"They think that the only thing wanting to ensure the success of such an undertaking would be the sanction of the Crown given in a conspicuous manner, and they are of opinion that no more efficacious mode could be adopted than the issue of a Royal Commission to inquire into and report upon the practicability of the scheme, and the best mode of executing it.

"I have, therefore, been asked, as President of the Society, to bring this matter officially before you, and to beg that Her Majesty's Government will give this subject their best consideration.

"The exhibition was proposed to be invited for 1851, and the magnitude of the necessary preliminary arrangements renders it highly desirable that the decision which the Government may have come to should be ascertained within the space of a few months.

"I have, &c.,

"(Signed) ALBERT.

"The Right Hon. Sir George Grey, Bart., G.C.B."

During the period necessary for Government inquiry, however, the Society did not remain idle. Looking to the cost necessarily to be incurred in carrying out this proposition, it was evident that it was quite beyond the means at the Society's disposal, and they therefore sought and found in Messrs. Munday, gentlemen who were willing to provide the necessary funds. The outlay for the building upon the scale then thought of, and for the preliminary expenses, was £70,000. And on the 23rd August, 1849, a contract was made, and on the 7th November following was signed, between the Society of Arts and the Messrs. Mundays, under which the latter in consideration of providing the necessary funds, were to receive in the first instance repayment in full of all moneys advanced, with 5 per cent. interest, and any residue at the close of the exhibition, was to be divided into three equal parts, one part to be paid to the Society of Arts as a fund for future exhibitions; the remaining two-thirds as remuneration to the contractors for the risk incurred in promoting the undertaking. Power was reserved to determine this contract before the 1st February, 1850, should the result of His Royal Highness's letter to the Government render such a course necessary or desirable. Meanwhile several members were appointed who acted under commission from His Royal Highness, as president of the Society, and who proceeded to the manufacturing districts in order to collect the opinions of the leading manufacturers, and obtain their support to the proposition. Public meetings were held, and local committees of assistance formed. Upon presentation of the reports from the commissioners to Her Majesty's Government, the Queen was pleased to issue a commission, which was published in the *London Gazette* of 3rd January, 1850, and for carrying on the work the commission states:—"Our further will and pleasure is that for the purpose of aiding you in the execution of these premises, we hereby appoint our trusty and well-beloved John Scott Russell, and Stafford Henry Northcote, to be joint secretaries to this our commission. And for carrying into effect what you shall direct to be done in respect of the Exhibition, we hereby appoint the said Henry Cole, Charles Wentworth Dilke the younger, George Drew, Francis Fuller, and Robert Stephenson, to be the Executive Committee in the premises, and Matthew Digby Wyatt, to be secretary of the said Executive Committee."

These gentlemen had been originally named by the Society in the contract-deeds with the Messrs. Munday as managers of the Exhibition.

At a special general meeting of the Society, held 8th February, 1850, the secretary made a statement as to the proceedings of the Council and Executive Committee

relative to the Great Exhibition of 1851, and resolutions were passed:—"That, in the opinion of the Society, the intention of H.R.H. the President to hold an Exhibition of the Works of Industry of All Nations in 1851 is worthy of his exalted position and character, and entitled to the hearty co-operation of all members of the Society, and that the Society hereby pledges itself to promote the object of H.R.H. the President to the best of its power." It was also resolved "That a subscription for promoting the Great Exhibition of the Works of Industry of all Nations be opened at the House of the Society of Arts." The subscriptions of members at the Society's House and in various localities amounted to £7,288. (See Report of Council, 22nd July, 1850.)

At the first meeting of the Commissioners, held on 11th January, 1850, it was resolved to terminate the contract with Messrs. Munday, and in July, 1850, the Commissioners were incorporated by letters patent, under the title of the "Commissioners for the Exhibition of 1851."

The Society's connection with the Exhibition may be said to have ceased on the determination of the contract with Messrs. Munday, whose claim for remuneration was settled under arbitration, the Society, in transferring its interest in the undertaking to the Royal Commission, not having reserved any legal claim to a share of the surplus profits should any arise. When, at the close of the Exhibition, a surplus of about £180,000 had been declared to have been realised, a supplementary charter, of the 22nd December, 1851, was granted to the Commissioners, which gave "them the power to dispose of the surplus in the furtherance of any plans that may be devised by them, to invest it in such manner as they may think fit, and generally to do whatever they may consider necessary for carrying out such plans, or maintaining and directing any establishment or institution to be founded in pursuance of them. It also empowers them to receive contributions in aid of the surplus, and to apply them in the furtherance of such plans; it gives them power to purchase and hold land and hereditaments in any part of her Majesty's dominions, and to apply or dispose of them in all respects as they may think fit."

In order to ascertain the views prevalent in the great centres of industry, as well as among other bodies, which had both provided funds to promote the Exhibition, as well as goods for exhibition, the Commissioners placed themselves in communication with such bodies with reference to the surplus funds at their disposal. As a result, applications were received from twenty-seven Literary and Mechanics' Institutions and Schools of Design, suggesting the application of the fund in promoting such Institutions; from the local committees and inhabitants of fourteen towns suggesting its use in the promotion of a central college of arts, manufactures, and commerce, in connection with provincial schools; and from forty-six other persons, or places, suggestions and applications were received, such as the establishment of a school of art for artist workmen—rewards for inventors—the conversion of the Exhibition building into a winter garden—a division of the surplus amongst the various towns in proportion to the amount subscribed, &c., &c. The Society of Arts, as the original promoters of the exhibition, asked for a grant of £10,000 in aid of a building fund to enable it to find more adequate accommodation for its wants, the absence of which accommodation prevented it from entering upon a more enlarged sphere of usefulness. The great majority of the suggestions, however, pointed to the use of the funds in the promotion of an extended art and industrial education, and this it was felt could not be carried out effectually by distributing comparatively small sums of money, and leaving the application of them to irresponsible bodies; the fund acquired was, therefore, invested in the purchase of an estate at South Kensington, upon which an industrial museum was erected, capable of being made available for the improvement of the taste and technical knowledge of the artisan, and at the same time affording a centre in which types of art industry might be collected and made available for improving the artistic taste and skill of the students of the Schools of Design throughout the country.

In order, however, to fit the working classes fully to avail themselves of the benefits the examples collected were capable of affording, an improved primary and scientific education was needed, and to aid the workman to obtain it the Society founded its Union of Institutions, and instituted an inquiry on the subject of industrial instruction.

When the accounts connected with the Exhibition had been finally adjusted, it was found that the surplus amounted to £186,436 18s. 6d., to which was added by Parliament the sum of £157,500 in aid of the purchase and development of the Gore House Estate.

At the meeting of the Society on November 13th, 1850, Mr. (afterwards Sir) Joseph Paxton read a paper on "The Origin and Details of Construction of the Building for the Exhibition of 1851;" and on November 28th, 1850, a circular was issued to the members as follows:—

"The present Council, as their last official act, have the satisfaction of announcing that Messrs. Fox, Henderson, and Company have kindly acceded to their request to permit a meeting to be held in the building at Hyde Park, on Tuesday, December 31st, at twelve o'clock, when a paper will be read by Professor Cowper, on 'The scientific means which have been employed in the construction of the building.' Members of the Society will doubtless recognise in this liberal act of the contractors a recognition of the important aid which the Society afforded as promoting the origin of the exhibition."

An extraordinary special meeting, of the members of the Society of Arts only, accordingly took place, when Professor Cowper explained the scientific construction of the building, and the different processes, machinery, and tools, which had been employed in its erection.

In November, 1850, the Council stated "that the Exhibition of 1851 appeared to render it almost superfluous for the Society to pursue its ordinary course for the encouragement of Arts, Manufactures, and Commerce, and the most useful work the Society could undertake, and one they believe to be strictly auxiliary to the views of their Royal President, H.R.H. the Prince Albert, and of Her Majesty's Commissioners, would be to encourage the production of philosophical treatises on the various departments of the Exhibition, which should set forth the peculiar advantages to be derived from each to the Arts, Manufactures, and Commerce of the country." The Council accordingly offered the large medal and £25 for the best, and the small medal and £10 for the second best, treatise on the objects exhibited in the sections of Raw Materials and Produce, Machinery, Manufactures, and Fine Arts, and the best general treatise on the Exhibition. The treatises were to occupy as nearly as possible eighty pages, of the size of the "Bridgwater Treatises." The treatises, if approved and rewarded by the Society, were to become the property of the Society, but the Council undertook to award to the authors the net amount of any profits which might arise.

This plan was, however, superseded, as at the close of the exhibition the following letter was received from H.R.H. Prince Albert:—

"Colonel Grey to the Secretary.

"Windsor Castle, October 15, 1851.

"SIR,—I am commanded by His Royal Highness Prince Albert to request that you will have the goodness to submit the following suggestion for the consideration of the Council of the Society of Arts.

"Connected as the Society has been with the original idea for the formation of such an Exhibition as that which has just closed, and with the preliminary arrangements for carrying it into effect, His Royal Highness is

sure that they will have taken the warmest interest in its further progress and development, and that they will wish to continue, to a certain degree, their connexion with it, by aiding, as far as in them lies, in the attainment of those advantages to art and industry which it was the object of the Exhibition to endeavour to procure.

"Nothing would tend more, in His Royal Highness's opinion, to the accomplishment of that object than a series of lectures given under the direction of the Society of Arts, at their weekly evening meetings, on the probable bearing of the Exhibition on the various branches of science, art, and industry.

"The lecturer in each branch being selected for his special knowledge and proficiency in it, it should not be his object to show the results to be expected from the exhibition on art and industry *generally*, but its probable immediate effect on the particular subject of his lectures; and on this he should state his opinion freely and without reserve.

"Among the subjects of such lectures I may enumerate the fine arts, chemistry as applied to manufactures, special processes of manufacture, mechanics, railroads, agriculture, tools and implements, commercial relations, political economy, &c., &c., &c.

"Differences of opinion would probably be found to exist among the lecturers on these different subjects, as to the effect to be expected from the Exhibition; but as each lecturer would confine himself to a particular subject, and give the result of his own reflections on that subject only, this would be of little importance.

"Such lectures could not fail to direct attention most beneficially to these important studies; and His Royal Highness believes that the Society of Arts, in instituting them, would be adopting the surest method of turning the Exhibition to good account, and would still further identify themselves with a scheme which had for its object, not the gratification of a passing curiosity, but the continued improvement and advance of science, art, and industry.

"I have the honour to be, Sir,
"Your obedient servant,
"C. GREY.

"George Grove, Esq."

"*Resolutions passed at a Meeting of Council, held on Monday, October 20th, 1851.*

"That the Council heartily affirm His Royal Highness's recognition of their having always taken the warmest interest in the progress and development of the Exhibition, and of their wish to continue their connexion with it.

"That they receive with gratitude His Royal Highness's letter, as a mark of his confidence that the Society may be made an instrument for perpetuating many of the beneficial results originated by that event.

"That the Council fully concur in the valuable suggestions made by His Royal Highness, and will proceed to take the necessary steps for carrying them into effect without delay."

Permission was sought to publish the letter suggesting the delivery of lectures, which was accorded, as follows:—

"*Colonel Grey to the Secretary.*

"Windsor Castle, October 22, 1851.

"MY DEAR SIR,—The Prince sees no objection to my letter being printed for circulation among the members of the Society of Arts.

"He desires me to add that, in carrying out his suggestion, everything will depend upon the proper selection of lecturers; and he trusts great care will be taken to secure, if possible, the assistance of the most able and eminent men in their several branches.

"I remain, yours faithfully,
"C. GREY.

"G. Grove, Esq."

Two courses of lectures were accordingly delivered.

(*To be continued.*)

INTERNATIONAL EXHIBITION OF DOMESTIC ECONOMY AT UTRECHT.

The Society for the Encouragement of Manufactures and Mechanical Industry in the Netherlands proposes to arrange an international exhibition of articles for daily household use, at Utrecht, in the months of August and September, 1869.

The principal object of this exhibition is to bring to the knowledge of the workman such articles of household use, furniture, dress, food, work, and instruction of different countries, as, at a low price, combine usefulness and solidity, so that he may be enabled, by judicious economy, to improve his condition. Articles of luxury as well as of elegance, strictly so called, are excluded. The exhibition will be classed as follows:—

CLASS 1.—HOUSES, &c.—(*a*) Plans of dwellings for married and single men. (*b*) Plans of lodging-houses, eating-houses, boarding-houses, baths, rooms for reading and recreation. (*c*) Details of construction. (*d*) Materials for such buildings.

CLASS 2.—HOUSEHOLD NECESSARIES.—(*a*) Furniture. (*b*) Bed and table linen. (*c*) Glass ware, table crockery, earthenware. (*d*) Warming. (*e*) Lighting. (*f*) Cleaning. (*g*) Hosiery, basket-work, tin utensils, &c.

CLASS 3.—CLOTHING.—(*a*) Printed calicoes. (*b*) Linen and cotton goods. (*c*) Woollen cloth. (*d*) Mixed fabrics. (*e*) Ready-made linen. (*f*) Ready-made clothes. (*g*) Articles in gutta-percha. (*h*) Knitted and netted goods. (*i*) Hats, caps, bonnets, &c. (*k*) Boots, shoes, &c. (*l*) Other articles of dress.

CLASS 4.—FOOD.—(*a*) Corn chandlers' wares. (*b*) Preserved meats. (*c*) Drinks. (*d*) Ways of preparing them.

CLASS 5.—WORKMEN'S AND GARDENERS' TOOLS.

CLASS 6.—MEANS OF MORAL, INTELLECTUAL, AND BODILY DEVELOPMENT.—(*a*) Books (school books excluded). (*b*) Music, musical instruments. (*c*) Indoor gymnastics. (*d*) Amusements, games, &c.

CLASS 7.—REPORTS, STATUTES, REGULATIONS OF DIFFERENT ASSOCIATIONS FOR PROMOTING THE WELL-BEING OF THE WORKING CLASSES.

All the articles are to be sent in between the 15th and 30th July.

The committee of management reserves the right, not only to sell the articles exhibited at the price indicated, but also to order others of the same sort, at the same price, during the exhibition.

The proceeds of articles sold, after deducting charges, will be remitted to the exhibitors at the expense of the latter.

Goods from abroad which are sent back will be exempt from export duty.

The central committee, in concert with the local commissions, will try to obtain from the different companies a reduction of the charge for carriage, or exemption if possible.

Goods cannot be reclaimed so long as the exhibition remains open.

The articles exhibited will be submitted to a jury, which will distribute medals and honourable mentions. The jury will be appointed by the central committee, which will at the same time draw up regulations for their guidance.

Exhibitors will have, at all times, personal free admission, on presenting a ticket with which they will be furnished by the committee of management.

A preliminary meeting, with the view to further the project for the above exhibition, was held at the Mansion-house, on Thursday, the 7th instant. The Lord Mayor presided, and there were present, among others, Baron Mackay, from the Hague, President of the Central Committee for the Exhibition; Mr. Everwyn, the Netherlands Chargé d'Affaires, and Mr. May, Consul-General; Sir John Lubbock, Bart., Vice-President of the Society of Arts; Major-General Sir Vincent Eyre, K.C.S.I., C.B., member of the Council of the

Society of Arts; Mr. Biddulph, M.P.; the Hon. Auberon Herbert; Mr. Edwin Chadwick, C.B., member of the Council of the Society of Arts; Mr. C. E. Norton, from the United States; Mr. Le Neve Foster, Secretary of the Society of Arts; Mr. Critchett, Assistant-Secretary of the Society of Arts; Mr. James Hole, Secretary to the Association of Chambers of Commerce; Mr. Adair, M.P.; the Rev. William Rogers, Mr. Hodgson Pratt, and Mr. Ellis Davidson. Baron Mackay explained the objects and nature of the intended exhibition, and advocated its claims to support in this country.

After some discussion, it was resolved that a committee be appointed, under the presidency of the Lord Mayor, to further the objects of the exhibition, consisting of the above-named gentlemen, and the following, from whom letters expressing their approval of the undertaking had been received:—Mr. Grant Duff, M.P.; Mr. George Shaw Lefevre, M.P.; the Right Hon. Russell Gurney, M.P.; Mr. Samuel Morley, M.P.; Mr. Thomas Hughes, M.P.; Mr. Peek, M.P.; Mr. George Cubitt, M.P.; the Hon. William Broderick, M.P.; Mr. G. O. Trevelyan, M.P.; Mr. J. P. Gassiot, F.R.S., Vice-President of the Society of Arts; Mr. Twining, Vice-President of the Society of Arts; Mr. Hyde Clarke, member of the Council of the Society of Arts; Sir Daniel Cooper, Bart., member of the Council of the Society of Arts; Mr. S. Teulon, member of the Council of the Society of Arts; Mr. S. Redgrave, member of the Council of the Society of Arts; and Mr. S. Andrews, auditor of the Society of Arts.

Fine Arts.

PARIS ACADEMY OF BEAUX ARTS.—The election of a foreign member of the academy, in the place of the late composer Rossini, has fallen on Signor J. Dupré, sculptor, of Florence. Signor Dupré exhibited in the Champ de Mars, in 1867—"Piety," a group in Marble; "The Infant Bacchus," a statuette; and "The Triumph of the Cross," bas-relief in plaster; and was awarded by the jury one of the grand prizes.

MEMORIAL STATUES IN CORSICA.—Ajaccio possesses an equestrian statue of Napoleon the First, a statue of Cardinal Fesch, and a splendid monument to the memory of Charles Abbatucci, the hero of Huningue; and the little town of Corte is about to erect a statue in honour of Joseph Buonaparte, King of Spain. This statue is to be executed by M. Vital Dubray, the sculptor of the Abbatucci monument already mentioned, and of several public works in Paris, Orleans, Montpellier, Rouen, and other towns, including a graceful statue of the Empress Josephine, erected during the time of the Exhibition of 1867 in the Boulevard bearing her name.

ART EDUCATION IN BELGIUM.—The efforts made towards the art education of the working men in all countries multiply daily. The municipal council of Brussels, aided by a vote of the Belgian Chamber, has reorganised its industrial museum, and opened a school for the artistic education of workmen.

FINE ART EXHIBITIONS AT LIEGE AND BRUSSELS.—An exhibition of painting, sculpture, and engravings is announced to take place at Liege, to be opened on the 29th of March and close on the 31st of May in the present year, to be organised by the Association for the Encouragement of the Beaux Arts, under the direction of the Society of Emulation, and with the patronage of the communal authority. At the last exhibition of the association, in 1866, the quantity of works of art was so large that the galleries would not contain them all, and the acquisitions formed a very handsome list. Works are to be sent in to the Société Libre d'Emulation at Liege at least a fortnight before the opening of the exhibition. The society bears the cost of carriage to Liege, if the works be sent by slow train, but the return charges are to be paid by the exhibitors. No work can be exhibited without the consent of the artist. The Brussels exhibition opens soon after the closing of that of Liege, and M. Ch. Kepume, the treasurer of the Liege association, will forward works on receipt of advice to that effect, from the latter to the former place.

Manufactures.

MANUFACTURES AT BIELLA.—The town of Biella is one of the most industrial in Piedmont, and the immense water-power of the mountain torrents supplies motive-power to the numerous manufactories. This water-power is estimated at 3,200 litres per second (14,400 gallons), with a fall of 320 metres. The principal manufactures are those of wool, being in number 102, with 2,854 looms. The value of the woollen stuffs annually made at Biella amounts to twenty-one millions of francs, or 9,500 francs per loom. The number of persons engaged in this industry is estimated at 8,562. The cotton mills employ upwards of 2,500 persons, and produce to the value of about five and a half millions. 680 workmen are employed in the manufacture of hats, which are produced to the value of two millions of francs every year. The produce of the paper mills, iron works, &c., amount to about two millions, and employ 1,600 persons; that of the potteries and furniture to one million of francs, and employ 550 workmen.

Commerce.

RUSSIAN COMMERCE BY WAY OF ASIA.—The commerce of Russia is at present not only rapidly improving, but it is undergoing great changes in various directions. An official document recently published states that the total commerce of the empire by the Asiatic frontier, amounted in 1867 to upwards of fifty millions of roubles, that is to say, six and a-half millions more than in 1866, and fifteen and a-half millions more than the average of the ten preceding years. The imports show an increase of nearly four millions, as compared with 1866, and of six and a-half over the decimal average, while the exports show a surplus of not quite three and ten millions respectively. The comparison of the years 1857 and 1867 shows the following striking results:—

	Imports.	*Exports.*
	Roubles.	Roubles.
1857	19,347,199	 11,945,598
1867	28,434,836	 24,639,548
Increase	9,087,637	 12,693,950

The total commerce of Russia with Europe and Asia amounted in 1867 to 510,074,769 roubles, being 71,078,504 in excess of the preceding year, and 124,748,450 more than the average of the ten years preceding. The import duties amounted in 1867 to 2,867,401 roubles, of which 1,221,000 was derived from tea, 590,000 from cotton goods, and 281,000 from refined sugar.

THE IMPROVEMENT OF THE SUGAR CANE.—The *Produce Markets Review* says:—"A little practical Darwinism is sadly wanted among colonial sugar planters, for, far from striving to improve their canes by selection, they work their soil to death with the varieties of the plant cultivated in the time of their ancestors. The saccharine strength of the cane thus remains stationary, or even decreases, while the strength of the beet has been doubled, by careful cultivation and selection, since the beginning of the century, and its improvement still progresses, until we have little doubt that in the course of time the saccharine percentage of the beet will be as great as that now possessed by the cane—namely, 18 per cent. Considering that the field beet, or mangoldwurzel, from which the sugar varieties have sprung, contains

only 4 per cent., such progress is wonderful; but bearing in mind what artificial selection has effected for so humble a plant, may it not be hoped that the cane may be improved in almost as great a proportion. It is not only with regard to the actual percentage of sugar that the cane requires study: the suitability of particular varieties to particular countries has not received the attention it deserves, and we are unaware that any experiments have been made of late years in crossing different kinds, with a view to altering their habits. In tropical countries, also, it would be possible, we should think, to get varieties which would ripen at different times of the year, and thus spread the gathering of the crop over a greater length of time, to the great benefit of the grower, by diminishing the pressure to sell at particular moments, and, in a greater degree, by giving more regular occupation to his hands. There is an unworked field, where, no doubt, many valuable kinds may be discovered. In Queensland and other parts of Australia we believe that many kinds of indigenous sugar cane grow wild on the river banks, and we hope shortly to publish an account of the extraordinary variety and richness of the cane in New Caledonia. Planters may depend upon it that a plant which stretches over so vast a portion of the earth's surface as from Australia, South Africa, and Peru, to the North of China, the South of Spain, Louisiana, and Texas—the different varieties of which have received hardly any attention—is capable of vast development. We have before pointed out, with regard to Mauritius, that the repeated failures of the crop were probably due to the exhaustion of the variety of the cane used, or, more probably, of some elements in the soil necessary to its growth. The bad promise of the present crop has directed public attention in Mauritius to this point, and the Chamber of Agriculture, alive to the importance of the introduction of new seed cane plants, presented to the Governor a report, in which the necessity of renewing the cane in the colony was pointed out, and government assistance solicited. The Governor was asked to send Dr. Meller, director of the Botanical Gardens, to Hong Kong, Japan, the Philippines, New Caledonia, the New Hebrides, the Society Islands, and Queensland, to procure and despatch new canes, and to allow a certain portion of the Botanical Gardens to be set apart for their propagation. His Excellency looked most favourably on this proposal, and Dr. Meller was to leave shortly for the places mentioned, a vote of £400 having been taken for his first expenses. We should have thought that the sugar canes of our vast Indian empire should also have been examined, the more especially as the Indian government has, with a wise foresight, devoted a good deal of attention to such subjects, and the Botanical Gardens at Calcutta has long been one of the leading establishments of the kind in the world."

Colonies.

STEAM COMMUNICATION WITH VICTORIA.—A Sydney paper says:—"An energetic effort is now being made in Melbourne to secure the support of the British Government to a scheme for subsidising a line of ocean steamers direct from England to Victoria, viâ the Cape of Good Hope. The subsidy asked for is £5,000 per month, or £60,000 per annum. The project is connected exclusively with Victoria, and no other colony will be asked to contribute to the subsidy. The advantages anticipated from the direct route, consist not only in increased postal communication, but in a large expected increase of immigration. To reduce the length of the voyage would remove much of the disinclination to come to Australia. Every one knows how much the extension of steam navigation stimulated the intercourse between England and America. If we could shorten the voyage to Australia, immigration would no doubt be proportionately stimulated. It is proposed to build for the contemplated line, large vessels with full steam power, calculated to make the run from Falmouth or Plymouth to Port Philip in forty-two days; if the voyage could be accomplished regularly even in forty-five days, it would alternate well with the Suez line."

EMIGRATION STATISTICS.—In 1867, the number of emigrants who left the Mersey was 115,681. In the year just concluded, the number was 129,337, or an increase of 13,656 on the year. Of the total number, 102,323 were for the United States, 15,409 for Canada, 1,601 for Victoria, and 340 for South America.

EXPORTS TO THE AUSTRALIAN COLONIES FROM THE UNITED KINGDOM.—The total amount of exports during the ten months ending October, 1868, was £9,372,891, against £7,570,213 in the year 1867. The exports to

	1868.	1867.
West Australia were valued at	£91,452 against	£67,944
South Australia "	982,270 "	731,497
Victoria "	4,317,287 "	3,492,852
New South Wales "	2,233,953 "	1,593,024
Queensland "	317,354 "	225,229
Tasmania "	161,010 "	186,910
New Zealand "	1,269,565 "	1,272,757

REVENUE OF NEW SOUTH WALES.—The following is a statement of the revenue of this colony, for the years ending 30th September, 1867 and 1868 respectively.

1867	£1,999,656
1868	2,005,244

The following are some of the principal details:—

	1867.	1868.
Customs	£783,125	£754,064
Excise	243,486	225,608
Land	547,681	546,228
Railway	176,265	216,709
Post Office	79,659	81,423
Stamps	63,807	60,779
Telegraphs	30,359	30,041
Gold	25,517	23,237

Notes.

BUDGET OF THE CITY OF PARIS.—Since the publication of the general annual budget for Paris, noticed in the *Journal*, No. 840, the Prefect of the Seine has issued the special budget of the city itself, from which we extract the following items:—The current expenses of the city were given in the notice above named. The total receipts on all accounts for the year 1868, according to this provisional account, including all special income, amount to 225,448,064 francs (£9,017,922), while the estimated expenditure exceeds that amount by five and a-half millions of francs. The budget for 1869, or rather the general estimate for the year, stands as follows:—

	Francs.
Receipts and expenses, ordinary and extraordinary, for the city of Paris	192,663,424
" " supplementary	15,500,000
" " special	16,038,397
Total (£8,968,073)	224,201,821

The expenditure for the current year will probably be much larger than that of 1868, for all the chief items increase yearly. The most important addition to the current year, noted in the document under hand, is that of the annual charge of the municipal debt, which is thus given:—

	Francs.
As shown in the account for 1867	19,130,872
Credited in the budget of 1868	21,044,364
Inscribed in the budget of 1869	46,170,824

Thus, the people of Paris will have to pay no less a sum

than £1,846,833 on account of the municipal debt alone. There is a change announced in the taxation of Paris. At present, persons not in business on their own account, and not rated at so much as ten pounds for rent, pay no house-tax; this exemption is now to be carried as far as a rating of sixteen pounds, which is stated to be equivalent to twenty pounds actual rent paid. In future, apartments rated not higher than twenty-four pounds will pay three per cent. house-tax; while the tax on dwellings of superior character is left as before, namely, five per cent. up to £40; seven per cent. on all under £60, and above that, nine per cent. per annum. The amount set down for public charity is under a million sterling, although 102 beds have been added to one hospital —a new hospital established for scrofulous children, and a new asylum for incurables. The sum set down for road-making, plantations, water, and sewers, is just a million sterling, or £22,856 more than in 1866. In the extraordinary expenditure are the following items:—£92,000 for the purchase of the privileges of the General Water Company and the Cab Company, and the tolls of certain bridges in the outskirts of Paris, and one or two other similar expenses. The following sums are set apart for important public works:—Roads and bridges, £127,212; architecture and the fine arts, £52,416; improvements of streets, £960,000; other public works, about £500,000. The amount set apart for architectural works and the fine arts is thus divided:—

	Francs.
Repairs of churches, &c.	300,000
„ municipal buildings and schools	200,000
Continuation of the repairs and embellishments of the Lycées	120,000
Completion of the new museum in the Hôtel Carnavalet	220,000
Fine arts and decoration	250,000
Minor items	220,393
Total	1,310,393

New churches, schools, or municipal buildings are provided for apart out of the special fund for great public works.

TECHNICAL EDUCATION IN ITALY.—The first examination of the students of the Technical Institution of Cuneo (which was established in 1865) was held this autumn. Out of 28 students who had completed their three years' course of study, and who presented themselves for examination, 26 passed, 20 having obtained a diploma in agricultural and land surveying, 4 in telegraphy, and 2 a licence as professors of mathematical and physical science. The Provincial Council of Cuneo has voted a sum of money to enable the two best students in agriculture to continue their studies abroad.

THE SUEZ CANAL.—In a communication to Paris, M. de Lesseps stated that a small schooner, "La Levrette," has recently passed through the Suez Canal, and that six vessels belonging to the Egyptian fleet are about to pass from one sea to the other. It now may be safely said that this canal is opened for vessels of small tonnage; and in six months' time ships of from 2,000 to 3,000 tons burden will be able to make use of the Suez Canal.

NEWSPAPERS IN SWITZERLAND.--The number of political newspapers published in Switzerland is at present 201. Of these 163 are in German, 31 in French, 4 in Italian, and 3 in Romany. Six are published seven times a week, 32 six times, 35 three times, 72 twice, and 54 once a-week.

Correspondence.

ARTIFICIAL REFRIGERATION.—SIR,—Our attention has been drawn to the paper read by Dr. Paul on artificial refrigeration, and the subsequent correspondence on the same subject. We regret that in the discussion following the reading of Dr. Paul's paper there was nothing advanced of an original or interesting nature, and the old familiar suggestions of cooling chambers and freezing ponds (acted upon by us years ago) were again brought out. Still, it was not our intention to have intruded upon you, but from the remarks made by Mr. Flower, in his letter of the 2nd inst., implying that we have been indebted to him for information or assistance; we can only say, if this be so, it is not within our recollection, and, until now, had the question been put to us, we should have said that the contrary was the case. Some time ago, our manager, Mr. West, happened to be in the neighbourhood of Stratford-on-Avon, and called upon Mr. Flower, and was shown the air-engine, and the method adopted for reducing the temperature of wort by means of a cooled solution of brine. On leaving, a presentation was made to our representative of a copy of Mr. Flower's patent for applying cold brine, &c., by means of Siebe's or Kirk's refrigerator, to the purpose of cooling worts, &c. Mr. Flower states that his intention in taking out a patent for this was simply to record the first practical application of artificial refrigeration to brewing. Now, surely, the refrigerative apparatus being ready to hand, it is really a very small matter of detail how the cooling power so obtained be employed; but even this Dr. Paul has shown in his letter has not been lost sight of, and so far back as 1857, Harrison in his specifications (No. 2,362, page 13) remarks, "I am aware that the employment of saline solutions for carrying frigorific power has been frequently proposed, &c.," and again, that his invention "consists in the combination of a refrigerative process by the continued and self-regulated circulation of a stream of ether or other volatile liquid, with the continued circulation of a stream of uncongealable liquid, conveying and diffusing the frigorific effect over large surfaces and to cooling worts, &c." Moreover, ten years ago, and up the time of his decease (some three years since), the late Mr. Daniel Siebe advocated the employment of brine, as (so to speak) a carrier of cold for brewing purposes. In support of this, we are prepared to give references to brewers if so desired. Brine is the medium we employ in our apparatus for cooling or freezing water. This being so, what originality, we ask, is there in diverting the application to cooling worts? If it does one it will do the other. The setting up, therefore, of a "record," alluded to by Mr. Flower, we fear can only tend to act as a deterrent to persons unacquainted with what has been done before, and desirous of using brine as a cooling medium. With regard to Mr. King's application of our machinery for cooling worts, and which has been such a remarkable success, we can state it was entirely original —was his own idea—and we must admit carried out even contrary to our advice to use brine. Apologising for taking up so much of your valuable space.—We are, &c., SIEBE, BROTHERS,

Mason-street, Lambeth, London, S., January 13th, 1869.

ARTIFICIAL REFRIGERATION.—SIR,—In reference to Mr. Flower's letter, published in last week's *Journal*, I have been all along quite well aware that Kirk's machine had been applied by Mr. Flower to cooling brine, which was then passed through an ordinary brewers' refrigerator. I was also aware that this mode of working has a certain advantage over ice-making, especially with Kirk's ice machine, which requires a very great expenditure of power for making ice. That advantage, however, is trifling compared with the advantage gained by Mr. King's plan of direct refrigeration, without any brine at all, since, in this latter case, the useful effect is nearly three times as great as when ice is made. I am unacquainted with any announcement of this fact by Mr. Flower, or of any indication by him of its possible realisation, and, so far as I can judge from his letters, he does not seem, even now, to appreciate this fact. Besides this, it is an advantage which cannot be obtained by any means with the air machine, and relates exclusively to the ether machine. These are the facts upon

which I based the opinion expressed in my paper, and until Mr. Flower advances anything beyond assertion against them, I shall venture to retain that opinion, and say nothing more on the subject.—I am, &c., BENJAMIN H. PAUL.

8, Gray's-inn-square, 13th January, 1869.

MEETINGS FOR THE ENSUING WEEK.

MON.....Social Science Assoc., 8. Mr. John Scott, "On the Inns of Court, their Functions and Privileges."
R. United Service Inst., 8½. 1. Capt. E. A. Inglefield, "His new Hydraulic Steering Apparatus, as being fitted to H.M.S. *Achilles*." 2. Lieut. Arthur H. Gilmore, R.N., will exhibit his "New Expanding Plug for stopping Shot Holes, and New Sponge for Artillery Practice."
British Architects, 8.
Medical, 8.
Asiatic, 3.
London Inst., 6.
Society of Engineers, 7½. President' Inaugural Address.
TUES ...Civil Engineers, 8. Renewed discussion on "Mechanical Appliances for Getting Coal;" and, time permitting, Mr. Henry Hooper, "New Ferry and New Brighton Piers."
Royal Inst., 3. Mr. Westmacott, "On Fine Art."
Statistical, 8. Mr. R. Dudley Baxter, "The Taxation and Capital of the United Kingdom."
Pathological, 8.
Anthropological, 4. Annual General Meeting.
WED ...Society of Arts, 8. Mr. Samuel Highley, "On Photography and the Magic Lantern applied to the Teaching of History."
Meteorological, 7.
R. Society of Literature, 8½.
THUR ...London Inst., 6.
Royal Inst., 3. Mr. Rupert Jones, "Protozoa."
Royal, 8½.
Antiquaries, 8½.
Linnæan, 8. Mr. Richard Spruce, "On the Palms of the River Amazon."
Zoological, 4.
Chemical, 8.
Numismatic, 7.
Royal Society Club, 6.
Society of Fine Arts, 8. Conversazione at the Gallery of the Female School of Art, Queen-square, Bloomsbury.
FRI .....Royal Inst., 8. Mr. A. Herschel, "Last Eclipse of the Sun."
Quekett Club, 8.
SAT .....R. Botanic, 3½.
Royal Inst., 3. Prof. Odling, "Hydrogen and its Analogues."

Patents.

From Commissioners of Patents' Journal, January 8.

GRANTS OF PROVISIONAL PROTECTION.

Artificial fuel—3154—W. E. Gedge.
Baths employed in coating metals—3871—J. Jones.
Boilers—3908—S. Smart.
Bottles, packing—3421—E. and F. Dixon.
Bricks, &c., ornamental—3939—W. H. Ridgway and F. W. Walker.
Building materials—3279—F. Ransome.
Buildings, &c., heating—3818—J. E. Scriven.
Carpets, &c.—3881—H. G. Thompson.
Carpets, &c.—3923—H. G. Thompson.
Carriages, combined open and closed—3823—O. Hollingworth.
Casks, sheet-metal—3731—J. A. Farwig and C. Haynes.
Casks, &c., ferrules for—3922—G. Lowry.
Chemical compounds—3525—D. Burns.
Cloth, &c., plaiting or doubling—3960—G. Slater.
Cod-liver oil, &c., treating—3928—A. V. Newton.
Colouring matters, preparing—3850—C. Liebermann and C. Graebe.
Conservatories, &c.—3252—R. S. Burn and E. S. Eyland.
Cooking apparatus—3774—B. Hunt.
Cooking apparatus—3926—F. P. Warren.
Copper and brass, electric deposition of—3930—W. H. Walenn.
Corn, treating—3912—A. Sezille.
Cravat fasteners—3529—F. D. Sutherland.
Diving apparatus—3811—C. E. Brooman.
Drying stoves, &c—3829—J. Worrall and J. Kershaw.
Filter vans and carts—3773—E. H. Bayley.
Fire-arms—3943—H. Hillebrandt.
Fire-arms, breech-loading—3946—C. Gordon.
Floating docks—3916—W. E. Gedge.
Forks for agricultural and horticultural purposes—3904—J. Palmer.
Gas—3909—F. N. Gisborne.
Gas—3954—A. Browne.
Gas burners—3929—A. M. Clark.
Glass furnaces—3931—T. Warren.
Hassocks, &c.—3918—E. M. Thornton.
Heat, indicating and regulating—3771—W. H. Bailey.
Horses, roughing—3717—W. Chiswell.
Hot-water apparatus—3917—B. W. Maughan.
Inkstands—3920—W. G. Reeve.
Iron—3883—I. Baggs.
Iron for plating vessels, &c.—2634—J. Jeavons and C. Martin.
Iron roads, &c., suspended—2709—E. Cortazzi.
Jewellery, &c., ornamenting—3641—R. A. Green.
Lamps, portable—3944—C. E. Brooman.
Locks—3676—L. J. Marechal.
Locks, &c.—3887—R. Whitaker.
Malt kilns, &c., constructing floors for—3936—R. Boby.
Metal pipes—3952—C. D. Abel.
Millstones, dressing—3688—H. Robinson.
Millstones, dressing—3935—H. Robinson and J. Smith.
Mines, ventilating—3910—J. Snape.
Motive-power—2734—J. Parker.
Motive-power—3940—A. C. Pilliner and J. C. Hill.
Motive-power engines—3869—M. S. Maynard and R. Grime.
Pianofortes, &c.—3948—J. P. Mills.
Pigments—2856—J. B. Spence and R. R. Kelly.
Press plates, heating—3819—J. Mill.
Printing surfaces, production of—3956—F. A. V. Michel.
Pulleys—3906—J. H. Johnson.
Punkahs or fans, apparatus for working—3937—H. C. M. Turnbull.
Railway signals—3410—C. E. and F. C. Winby.
Railway trains, communication in—3752—T. Sturgeon.
Railway trains, communication in—3899—W. R. Clark.
Reaping apparatus—2786—S. G. Archibald.
Rolling mills—3934—C. D. Abel.
Saddle cloths, &c.—3889—J. Wilkinson, jun.
Sash lines, &c—3921—G. Hookham.
Saucepans, &c., metallic lids for—3831—F. Ryland.
Sewage, treating—3914—J. G. Jennings.
Sewing machines, &c.—3958—F. N. Gisborne.
Steam engines—3456—A. J. Deblon.
Steam ploughs, &c.—2746—H. Cowing.
Taps—3895—W. E. Gedge.
Teeth, plates for holding artificial—3924—J. H. Johnson.
Telegraph cables, submarine—3938—H. Clifford.
Thread or twine wound upon bobbins, &c.—3866—M. Brown-Westhead and R. Smith.
Torpedoes, &c.—3907—F. N. Gisborne.
Umbrellas, &c.—3875—T. Warwick and A. Boyle.
Valves—3897—J. Clayton.
Velocipedes—3962—R. and T. Hughes.
Vessels, reefing and unreefing the mainsail, &c., of—3902—J. Jensen.
Watches—3942—W. Ehrhardt.
Wells, sinking—3764—J. F. Bentley.
Windows—3873—J. Dickson.
Wood, &c., cutting and shaping—3964—S. and W. Fox, J. Reffitt, and G. Grange.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

Gold, &c., coating articles with—23—H. A. Bonneville.
Lawn-mowers—37—A. W. C. Williams.
Malt, &c., apparatus for drying, &c.—3976—H. A. Bonneville.

PATENTS SEALED.

2172. M. Bebro.
2179. H. H. Doty.
2185. W. L. G. Wright.
2186. E. T. Hughes.
2190. J. D. Churchill.
2199. C. E. Brooman.
2201. E. Edwards.
2246. G. Moulton.
2342. A. V. Newton.
2355. A. V. Newton.
2379. A. V. Newton.
2486. W. E. Newton.
2589. A. Clark.
3138. W. R. Lake.
3345. R. W. Beckley.
3371. J. Taylor, jun.
3495. W. R. Lake.

From Commissioners of Patents' Journal, January 12.

PATENTS SEALED.

2204. G. B. Puricelli.
2209. G., G. W., & J. Betjemann.
2210. W. R. Lake.
2214. J. Bastow.
2221. C. J. Galloway and C. H. Holt.
2223. J. Thompson and J. G. Ingram.
2228. C. de Bergue and J. C. Haddan.
2233. J. Bonnall.
2235. W. Turner.
2251. J. Duguid, jun.
2252. W. J. C. Muir.
2253. C. J. Galloway and C. H. Holt.
2282. W. H. and A. M. Bates and H. Faulkner.
2292. A. M. Clark.
2328. G. Smith.
2341. J. Brigham & R. Bickerton.
2347. A. M. Clark.
2357. A. M. Clark.
2360. W. Lewis.
2476. W. E. Newton.
2477. G. Leach.
2562. B. Hunt.
3146. J. Robertson.
3151. W. R. Lake.
3192. W. E. Newton.
3336. J. H. Bertie.
3399. W. M. Brown.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

43. H. D. P. Cunningham.
104. A. H. Hart.
58. H. N. Penrice.
94. C. Bartholomew.
92. T. A. Blakely and J. Vavasseur.
122. C. G. Johnson.
137. E. M. Boxer.
100. F. J. King.
109. R. T. Sutton.
139. C. Moriarty.
294. L. Sterne.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

60. J. Smith and S. Wellstood.
59. C. W. Siemens.
138. W. L. Winans.
46. J. Tatham.
77. W. H. Preece.
81. T. Ramsay.
82. H. Charlton.